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TITLE: GEOGRAPHIC DATABASE
INCLUDING DATA INDICATING
WIRELESS COVERAGE AND
METHOD AND SYSTEM FOR USE
THEREOF

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1 GEOGRAPHIC DATABASE INCLUDING
2 DATA INDICATING WIRELESS COVERAGE
3 AND METHOD AND SYSTEM FOR USE THEREOF
4

5 BACKGROUND OF THE INVENTION

6   The present invention relates to geographic data and systems that use geographic

7 data, and more particularly, the present invention relates to a feature provided by a

8 system, such as a navigation system, whereby a user of the system is provided with

9 information that indicates areas in which navigation-related data are available wirelessly.

10   There are various computer architectures for navigation systems that provide

11 navigation-related features (including map-related features). In one type of architecture

12 for a navigation system, end users (such as vehicle drivers, passengers, and others) use a

13 wireless communications system to obtain navigation-related services or data from a

14 remotely located navigation services provider. The end users use various computer

15 platforms (e.g., different kinds of electronic devices and/or systems) to connect to the

16 wireless communications system to access the remotely located navigation service

17 provider. Associated with the remotely located navigation services provider is a

18 geographic database. When an end user uses his/her computer platform to request a

19 navigation-related service or data, the remotely located navigation service provider

20 accesses the geographic database associated therewith and then provides the requested

21 service or data to the requesting end user's computer platform via the wireless

22 communications system.

23   This type of navigation system architecture provides several advantages. One

24 advantage relates to providing updated data. There is a continuing need to update the

25 data used by a navigation system. For example, new streets are built, road construction

26 closes roads, detours are established, new businesses open, posted speed limits change,

27 new turn restrictions are established at intersections, streets are renamed, and so on.

28 These kinds of changes can affect travel through a geographic region. Accordingly, the

29 data used by a navigation system should be updated on a regular basis to accurately

1   reflect changes in the represented geographic features. A computer architecture in which

2   end user computing platforms obtain data from a single central geographic database

3   associated with a navigation services provider affords an advantage with respect to the

4   updating of the geographic data. With a computer architecture in which end user

5   computing platforms obtain data wirelessly from a single central geographic database

6   associated with a navigation services provider, updates need to be applied only to the

7   central database.

8   Although there are advantages associated with a navigation system architecture in

9   which individual end user computer platforms request and obtain navigation-related

10   services and data wirelessly from a single central geographic database associated with a

11   navigation services provider, there are considerations that need to be addressed. One

12   consideration relates to the coverage area(s) in which end users can obtain navigation-

13   related services and data wirelessly. According to one type of navigation system

14   architecture, a navigation services provider provides navigation-related services and data

15   with respect to a coverage area. A wireless communications system, associated with the

16   navigation services provider, is available throughout the coverage area. End users

17   located throughout the coverage area use the wireless communications system to access

18   the navigation services provider to obtain navigation-related services and data. The

19   coverage area served by the wireless communications system and navigation services

20   provider may correspond to a metropolitan region. Alternatively, the coverage area

21   associated with a navigation services provider may correspond to a state or region of the

22   country. Thus, within an entire country, such as the United States, there may be a

23   number of different coverage areas that are served by one or more navigation services

24   providers. According to this type of navigation system architecture, navigation-related

25   services and data are not available wirelessly outside the coverage areas. The

26   unavailability of navigation-related services or data outside of coverage areas may be

27   inconvenient to some end users. Accordingly, it would be preferable to reduce or

28   minimize any inconvenience to end users of this navigation system architecture

29   occasioned by the lack of navigation-related services or data outside the coverage areas

30   served by wireless communications systems associated with navigation services

31   providers.

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SUMMARY OF THE INVENTION

To address these and other objectives, the present invention comprises wireless coverage data associated with a geographic database that contains data that represent a road network in a geographic region. The wireless coverage data indicate one or more areas within the geographic region in which navigation-related services or data from a navigation services provider are available wirelessly, or conversely, areas within the geographic region in which navigation-related services or data from a navigation services provider are not available wirelessly. An end user obtains the wireless coverage data. The wireless coverage data are used to indicate to the end user areas in which navigation-related services or data from a navigation services provider are available wirelessly or areas in which navigation-related services or data from a navigation services provider are not available wirelessly. The wireless coverage data may also be used to warn the end user when he/she is leaving an area in which navigation-related services or data from a navigation services provider are available wirelessly. Data for uncovered areas can be downloaded to an end user's computing platform while the end user is still within an area in which navigation-related data and services from a navigation services provider are available wirelessly.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a map showing a geographic region.

Figure 2 a map showing a portion of the geographic region shown in Figure 1.

Figure 3 is a block diagram that shows some of the components of a road segment data record contained in the geographic database of Figure 2.

Figure 4 is a block diagram that shows some of the components of a node data record contained in the geographic database of Figure 2 according to an alternative embodiment.

Figure 5 is a block diagram that shows some of the components of a postal zone data record contained in the geographic database of Figure 2 according to an alternative embodiment.

1   Figure 6 is a block diagram that shows some of the components of an

2   administrative area data record contained in the geographic database of Figure 2

3   according to an alternative embodiment.

4   Figure 7 is a block diagram that shows some of the components of a wireless

5   coverage area data record contained in the geographic database of Figure 2 according to

6   an alternative embodiment.

7   Figure 8 is a block diagram showing components of one of the end user's

8   computing platforms shown in Figure 2.

9   Figure 9 is an illustration of the end user's computing platform of Figure 8

10   showing a map image on the display screen relating to a wireless coverage.

11   Figure 10 is an illustration of the end user's computing platform of Figure 8

12   including a visual warning message about the availability of wireless coverage.

13   Figure 11 is an illustration of the end user's computing platform of Figure 8

14   including an audible warning message about the availability of wireless coverage.

15

16   DETAILED DESCRIPTION OF THE
17   PRESENTLY PREFERRED EMBODIMENTS

18   I.   WIRELESS COVERAGE DATA IN GEOGRAPHIC DATABASE

19   A.   Navigation system with wireless coverage areas

20   Figure 1 is a map showing a geographic region 100. In Figure 1, the geographic

21   region 100 includes a portion of the Midwest United States. The portion shown in

22   Figure 1 is exemplary and the present embodiment can be applied in any geographic

23   region in the United States or in any other country.

24   In the map of the geographic region 100 in Figure 1, several wireless coverage

25   areas 110 are shown. These wireless coverage areas 110 are labeled, 110(1), 110(2),

26   110(3) . . . etc. In the geographic region 100 shown in Figure 1, some of these coverage

27   areas 110 correspond to metropolitan areas, or combinations of metropolitan areas. For

28   example, the wireless coverage area 110(1) corresponds to the Chicago and Milwaukee

29   metropolitan areas and the wireless coverage area 110(2) corresponds to the Indianapolis

30   metropolitan area. In addition, some of the coverage areas 110 in Figure 1 correspond to

31   connecting travel corridors. For example, the wireless coverage area 110(3) corresponds

32   to a connecting travel corridor located between Chicago and Indianapolis. (The wireless

1   coverage area 110(3) is located along I-65.) The coverage areas 110 indicated in Figure 1

2   indicate areas in which navigation data area available wirelessly from a navigation

3   services provider.

4   Figure 2 is a map showing a portion 130 of the geographic region 100 shown in

5   Figure 1. The portion 130 of the geographic region 100 shown in Figure 2 includes the

6   wireless coverage area 110(1) that corresponds to the Chicago and Milwaukee

7   metropolitan areas. The portion 130 of the geographic region 100 shown in Figure 2 also

8   includes some areas 140 that are located outside the wireless coverage areas 110.

9   The wireless coverage area 110(1) is served by a navigation services provider

10   200(1). The navigation services provider 200(1) is part of a navigation services system

11   210. The navigation services system 210 serves end users (e.g., vehicle drivers and

12   passengers, as well as other persons) in the wireless coverage area 110(1). The

13   navigation services system 210 is used by the end users to obtain navigation-related

14   services (including map-related services) and/or data wirelessly from the navigation

15   services provider 200(1) while the end users are located in the wireless coverage area

16   110(1). The navigation-related services or data that the end users obtain from the

17   navigation services provider 200 relate to the wireless coverage area 110(1) as well as

18   areas outside the wireless coverage area 110(1). The navigation-related services include

19   information about travel along roads 224 located in the wireless coverage area 110(1) as

20   well as roads located in areas outside the wireless coverage area 110(1). The navigation-

21   related services include route calculation and guidance, people and business finding

22   services (e.g., electronic yellow and white pages), maps, point of interest searching,

23   destination selection, and so on.

24   End users located in the coverage area 110(1) use various different computer

25   platforms 230 to access the navigation services provider 200 to request and obtain

26   navigation-related and map-related features and geographic data. These various

27   computer platforms 230 (also referred to as "end user computing devices" or "client

28   computing platforms") may include navigation system units 232 located in vehicles 234,

29   personal computers 236, personal organizers (e.g., PDAs, PalmPilot®-type devices) 238,

30   portable phones 240, or any other types of computing device.

1   The various end user computing platforms 230 access the navigation services

2 provider 200 over a data communications network 250. The data communications

3 network 250 may be part of, or connected to, the Internet. The data network 250 may use

4 any suitable technology and/or protocols that are currently available, as well as

5 technology and/or protocols that become available in the future. For example, the data

6 network may use WAP, TCP/IP, etc. More than one protocol may be used in the data

7 network 250 with appropriate conversions.

8   At least a portion of the data communications network 250 includes a wireless

9 portion 254. The wireless portion 254 of the data communications network 250 enables

10 two-way communication between the end user computing platforms 230 and the

11 navigation services provider 200(1). The wireless portion 254 may be implemented by

12 any suitable form of wireless communication, including cellular, PCS, satellite, FM,

13 radio, or technologies that may be developed in the future. The wireless portion 254 may

14 include one or more transmitters, such as a transponder tower, an antenna tower, an FM

15 tower, satellites, or other suitable means. The transmitters include an appropriate

16 communication link to the navigation services provider 200(1). This link may be land-

17 based or may be wireless.

18   At least some of the end user computing devices 230 are mobile devices. These

19 mobile end user computing devices 230 use the wireless portion 254 of the data

20 communications network 250 to access the navigation services provider 200(1). These

21 mobile end user computing devices 230 includes the appropriate hardware and software

22 to access the navigation services provider 200 over the wireless communications network

23 254 of the data network 250. Some end user computing devices may not be mobile

24 devices. For example, these non-mobile end user computing devices may include

25 desktop personal computers 236. These non-mobile end user computing devices 230

26 may access the navigation services provider 200(1) over the data communications

27 network 250 without using the wireless portion 254.

28   As mentioned above, the end users obtain navigation-related services or data

29 wirelessly from the navigation services provider 200(1) while the end users are located in

30 the wireless coverage area 110(1). So long as the end users remain in the coverage area

31 110(1), they are within the range of service coverage of the wireless communications

1   system 254 and can obtain navigation-related services or data from the navigation

2   services provider 200(1). However, if an end user travels outside the wireless coverage

3   area 110(1), he/she becomes out of range of the service coverage of the wireless

4   communications system 254 and as a result, is unable to obtain navigation-related

5   services or data wirelessly from the navigation services provider 200(1).

6   In order to assist end users, a present embodiment includes a feature whereby end

7   users are provided with information about the geographic range of availability of wireless

8   navigation-related or data services. In one embodiment, end users are provided with

9   wireless coverage data that indicate the geographic range of availability of wireless

10   navigation-related or data. These wireless coverage data can be used by an application in

11   the end user's computing device 230 to indicate to the end user where (geographically),

12   navigation-related or data are available wirelessly. In addition, these wireless coverage

13   data can also be used to indicate to the end user where (geographically), navigation-

14   related or data are not available wirelessly. (This information about wireless coverage

15   availability can be used on the end user's computing device in several different ways, as

16   explained in more detail below.)

17

18   B.   <u>Wireless coverage data</u>

19   According to one embodiment, the wireless coverage data are associated with (or

20   included in) a geographic database 300. The geographic database 300 is used by the

21   navigation services system 210. The geographic database 300 includes data representing

22   the roads and intersections in the wireless coverage area 110(1). The data contained in

23   the geographic database 300 includes information relating to the represented roads and

24   intersections, such as turn restrictions at intersections, speed limits along the roads, street

25   names of the various roads, address ranges along the roads, and so on. The geographic

26   database 300 also contains information about points of interest and businesses located in

27   the wireless coverage area 110(1). The geographic database 300 also contains other

28   information about the wireless coverage area 110(1), such as information about

29   government divisions (e.g., cities, states), government services (e.g., police stations, post

30   offices, community centers), postal zones, area codes, etc. In this embodiment, the

31   geographic database 300 also includes data about areas outside the wireless coverage area

1   110(1). However, in an alternative embodiment, the geographic database 300 does not

2   necessarily include data about areas outside the wireless coverage area 110(1).

3   According to some embodiments, the wireless coverage data are included as data

4   attributes of other geographic features that are represented by the geographic database

5   300.

6

7   *(1)*   *Wireless coverage as an attribute of road segment data*

8   In one embodiment, wireless coverage data are included as attributes of road

9   segment data. The geographic database 300 in Figure 2 includes data that represents

10   roads. In the embodiment of the geographic database 300, there is at least one database

11   entry (also referred to as "entity" or "record") for each road segment represented in a

12   geographic region. A road segment refers to a portion of a road between two

13   immediately adjacent intersections or between a dead end and the intersection

14   immediately adjacent to the dead end. A road segment can also refer to a portion of a

15   road along which all the attributes of the road are the same.

16   Figure 3 shows some of the components of a data record 310 that represents a

17   road segment. The road segment data record 310 is included in the geographic database

18   300. Each road segment data record 310 may have associated with it information (such

19   as "attributes", "fields", etc.) that describe features of the represented road segment. The

20   road segment record 310 includes a segment ID 310(1) by which the data record can be

21   identified in the geographic database 300. The road segment data record 310 may also

22   include data 310(2) that indicates the restrictions, if any, on the direction of vehicular

23   travel permitted on the represented road segment. The road segment data record 310

24   includes data 310(3) that indicates a speed limit or speed category (i.e., the maximum

25   permitted vehicular speed of travel on the represented road segment). The road segment

26   data record 310 may also include data 310(4) indicating whether the represented road

27   segment is part of a controlled access road (such as an expressway), a ramp to a

28   controlled access road, a bridge, a tunnel, a toll road, a ferry, and so on.

29   The road segment data record 310 also includes data 310(5) providing the

30   geographic coordinates (e.g., the latitude and longitude) of the endpoints of the

31   represented road segment. In one embodiment, this data 310(5) are references to the

1   node data records 312(1) and 312(2) that represent the endpoints of the represented road

2   segment.

3   The road segment data record 310 also includes data 310(6) indicating the postal

4   zone in which the road segment is located, data 310(7) indicating the state in which the

5   road segment is located, and data 310(8) indicating the city in which the road segment is

6   located.

7   The road segment record 310 may also include or be associated with other data

8   310(9) that refer to various other attributes of the represented road segment. For

9   example, the road segment data record may include data identifying what turn restrictions

10   exist at each of the nodes which correspond to intersections at the ends of the represented

11   road segment, the name or names by which the represented road segment is known, the

12   street address ranges along the represented road segment, and so on. The various

13   attributes associated with a road segment may be included in a single road segment

14   record, or preferably are included in more than one type of road segment record which

15   are cross-referenced to each other.

16   In the embodiment shown in Figure 3, the road segment record 310 includes a

17   data attribute 310(10) relating to wireless coverage. The wireless coverage data attribute

18   310(10) indicates whether navigation-related services or data are available wirelessly

19   from a remotely located navigation services provider when an end user is located on the

20   road segment represented by the road segment record. The wireless coverage data

21   attribute 310(10) may also identify the navigation services provider and the levels of

22   service that are available (if different levels exist), as well as other data.

23

24   (2)   _Wireless coverage as an attribute of node data_

25   In alternative embodiments, data that indicate the range of wireless coverage can

26   be associated with data that represent types of geographic features other than road

27   segments. As an example, according to a second embodiment, data that indicate the

28   range of wireless coverage can be associated with data records that represent nodes.

29   Nodes refer to the points at each end of a road segment. According to this embodiment,

30   the geographic database 300 includes data records that represent nodes, i.e., node data

31   records. Some of the components of a node data record 312 are shown in Figure 4. Each

1   node data record 312 may have associated information (such as "attributes", "fields",

2   etc.) that describe features of the represented node. The node record 312 includes a

3   node ID 312(1) by which the data record can be identified in the geographic database

4   300. The node record 312 also include data 312(2) that indicate the geographic position

5   (e.g., its latitude and longitude coordinates) of the represented node. The node record

6   312 may also include data 312(3) that indicate the road segment(s) that connect to it. The

7   node record 312 may also include or be associated with other data 312(4) that refer to

8   various other attributes of the represented node.

9   In this embodiment, the node record 312 includes a data attribute 312(5) relating

10   to wireless coverage. The wireless coverage data attribute 312(5) indicates whether

11   navigation-related services or data are available wirelessly from a remotely located

12   navigation services provider when an end user is located at the node represented by the

13   node record. The wireless coverage data attribute 312(5) may also identify the navigation

14   services provider and the levels of service that are available, as well as other data.

15

16   *(3)*   *Wireless coverage as an attribute of postal data*

17   In another alternative embodiment, data that indicate the range of wireless

18   coverage can be associated with data that represent postal zones. According to this

19   embodiment, the geographic database 300 includes postal zone records. Some of the

20   components of a postal zone record 316 are shown in Figure 5. The postal zone record

21   316 includes an ID 316(1) by which the postal zone record can be identified in the

22   geographic database 300. The postal zone record 316 may also include data 316(2) that

23   indicate the communities located within the represented postal zone. The postal zone

24   record 316 may also include data 316(3) that indicate the locations(s) of post offices

25   within the represented postal zone. The postal zone record 316 may also include or be

26   associated with other data 316(4) that refer to various other attributes of the represented

27   postal zone.

28   In this embodiment, the postal zone record 316 includes a data attribute 316(5)

29   relating to wireless coverage. The wireless coverage data attribute 316(5) indicates

30   whether navigation-related services or data are available wirelessly from a remotely

31   located navigation services provider when an end user is located in the postal zone

1   represented by the postal zone record. The wireless coverage data attribute 316(5) may

2   also include other types of information, as explained above.

3

4   *(4)   Wireless coverage as an attribute of administrative data*

5   In a fourth embodiment, data that indicate the range of wireless coverage are

6   associated with data records that represent administrative zones. Administrative zones

7   include countries, states, cities (towns, villages, etc.), counties, townships, provinces, etc.

8   According to this embodiment, the geographic database 300 includes administrative zone

9   records. Some of the components of an administrative zone record 320 are shown in

10 Figure 6. The administrative zone record 320 includes an ID 320(1) by which the

11 administrative zone record can be identified in the geographic database 300. The

12 administrative zone record 320 also includes data 320(2) that indicate related

13 administrative zones. The administrative zone record 320 may also include data 320(3)

14 that indicate the locations(s) of administrative buildings (e.g., city halls, state capitols,

15 court houses) within the represented administrative zone. The administrative zone data

16 record 320 also includes data 320(4) that indicate the boundaries of the administrative

17 zone. The administrative zone record 320 may also include or be associated with other

18 data 320(5) that refer to various other attributes of the represented administrative zone.

19 In this embodiment, the administrative zone data record 320 also includes a data

20 attribute 320(6) relating to wireless coverage. The wireless coverage data attribute

21 320(6) indicates whether navigation-related services or data are available wirelessly from

22 a remotely located navigation services provider when an end user is located in the

23 administrative zone represented by the administrative zone record. The wireless

24 coverage data attribute 320(6) may also include other types of information, as explained

25 above.

26

27 *(5)   Wireless coverage defined with an arbitrary boundary*

28 In another alternative embodiment, data that indicate the range of wireless

29 coverage can be defined with respect to an arbitrary boundary. According to this

30 embodiment, the geographic database 300 includes wireless coverage area records. Some

31 of the components of a wireless coverage area record 322 are shown in Figure 7. The

1   wireless coverage area record 322 includes an ID 322(1) by which the wireless coverage

2   area record can be identified in the geographic database 300. The wireless coverage area

3   record 322 also includes data 322(2) that indicate the boundaries of the represented

4   wireless coverage area. The boundaries of the wireless coverage area can be defined in

5   any way. The wireless coverage data attribute 322(3) may also identify the navigation

6   services provider and the levels of service that are available, as well as other data, as

7   explained above. The wireless coverage area record 322 may also include or be

8   associated with other data 322(4) that refer to various other attributes of the wireless

9   coverage area.

10

11   II.   USE OF WIRELESS COVERAGE DATA

12   As mentioned above, the wireless coverage data that indicate the geographic

13   range of availability of wireless navigation-related services or data are provided to end

14   users. The wireless coverage data is used by end users to indicate where (geographically)

15   navigation-related services or data are available wirelessly.

16

17   A.   The end users' computing platforms

18   As mentioned above, each end user uses a computing platform (230 in Figure 2)

19   to obtain data or navigation-related or map-related services from the navigation services

20   provider 200(1). Figure 8 is a block diagram that shows components included in one of

21   the end user's computing platforms 230. As mentioned above, end users may use

22   different kinds of computing platforms to access the navigation services provider 220(1).

23   Different end user computing platforms may have different hardware and software and

24   the navigation-related functions that are performed on the end users' computing

25   platforms may vary from one end user platform to another. Accordingly, Figure 8 shows

26   an example of one configuration of an end user computing platform. It is understood that

27   not all end user computing platforms may necessarily provide all the functions described

28   in connection with the embodiment in Figure 8 and that some end user computing

29   platforms may provide additional or other functions.

30   Although the different end user computing platforms may have different hardware

31   and software resources, all the end user computing platforms receive data from the

1 navigation services provider (200(1) in Figure 2). The end user's computing platform

2 230 includes a communications system 400. The communications system 400 in the end

3 user's computing platform 230 includes the hardware and software components needed to

4 receive messages from and send messages to the navigation services provider (200(1) in

5 Figure 2) over the data network 250. The communications system 400 interfaces with

6 other components in the end user's computing platform 230.

7 The end user's computing platform 230 also includes a user interface 410. The

8 user interface 410 allows the end user to provide input to and receive information from

9 the end user's computing platform 230. The user interface 410 includes hardware and

10 software components. For example, the user interface 410 may include a display, a

11 microphone, speakers, a keypad, or other kinds of means for inputting information into

12 the computing platform and outputting information therefrom. The user interface 410

13 includes supporting software that may provide menus, prompts, audio, etc. The user

14 interface 410 interfaces with other components in the end user's computing platform 230.

15 Included on the end user's computing platform 230 are navigation-related

16 applications 420. The navigation-related applications 420 use the data obtained from the

17 navigation services provider 200(1). One of the navigation-related applications 420 is a

18 positioning application 420(1). The positioning application 420(1) uses geographic data

19 obtained from the navigation services provider 200(1) to determine the position of the

20 end user's computing platform 230 relative to data representing the road network. The

21 positioning application 420(1) may also obtain data from a positioning system 430 which

22 is part of the end user's computing platform 230. The positioning system 430 may use

23 GPS, dead-reckoning, or a combination of these or other technologies to determine the

24 location of the end user's computing platform 230. Methods for performing positioning

25 are disclosed in U.S. Pat. No. 6,192,312, the entire disclosure of which is incorporated

26 herein by reference. The positioning system 430 may also use technologies that

27 determine cell phone positions (or other wireless phone positions) in a geographic area.

28 These technologies may employ triangulation, time-of-arrival, or other techniques

29 implemented with equipment located away from a cell phone to determine the location of

30 the cell phone in a geographic area. The positioning application 420(1) and the

1 positioning system 430 are optional, i.e., not all end users' computing platforms may

2 provide for or support positioning.

3   Another of the navigation applications 420 on the end user's computing platform

4 is route guidance 420(2). The route guidance application 420(2) uses data from the

5 navigation services provider 200(1) to provide instructions for the end user to travel to a

6 desired destination. Methods for performing route guidance using geographic data are

7 disclosed in U.S. Pat. No. 6,199,013, the entire disclosure of which is incorporated herein

8 by reference.

9   Another of the navigation applications 420 on the end user's computing platform

10 is map display 420(3). The map display 420(3) uses data from the navigation services

11 provider 200(1) to provide maps graphically on the display screen of the user interface

12 410 of the end user's computing platform. The maps may show the area around the

13 location of the end user's computing platform, the area along a route that the end user is

14 following, the area around a location specified by the end user, or any other specified

15 area. Methods for performing map display using geographic data are disclosed in U.S.

16 Pat. Nos. 6,092,076 and 6,163,749, the entire disclosures of which are incorporated

17 herein by reference.

18

19   B.   Using wireless coverage data on an end user's computing platform

20   As mentioned above, the wireless coverage data can be used to indicate to end

21 users where (geographically), navigation-related services or data are available wirelessly

22 (and likewise where navigation-related services or data are not available wirelessly). In

23 one embodiment, end users' computing platforms 230 request wireless coverage data

24 from the navigation services provider 200(1). An end user's computing platform 230

25 makes this request while it is located within one of the areas in which navigation-related

26 or map-related data are available wirelessly.

27

28   *(1)*   *Displaying wireless coverage areas*

29   In one embodiment, when the end user's computing platform receives the wireless

30 coverage data, it uses the wireless coverage data to show a coverage map on the display

31 screen of the end user's computing. The coverage map may be generated by a coverage

1   map generation application 420(6)(1). The coverage map generation application

2   420(6)(1) may be included on the end user's computing platform. The coverage map

3   generation application 420(6)(1) may be part of the map display program installed on the

4   end user's computing platform. Alternatively, the coverage map generation application

5   420(6)(1) may be a separate program. According to still another alternative, the coverage

6   map generation application 420(6)(1) may be downloaded as an applet or a plug-in from

7   the navigation services provider 200(1) along with the wireless coverage data.

8   The coverage map rendered on the display screen of the end user's computing

9   platform indicates the areas in which navigation-related or map-related data are available

10   wirelessly and also indicates areas in which navigation-related or map-related data are not

11   available wirelessly. In a preferred embodiment, the coverage map also shows the

12   current position of the end user's computing platform. Figure 9 shows an example of this

13   feature. Figure 9 shows the display screen of the user interface 410 of the end user's

14   computing platform 230. On the display screen is a map showing areas in which

15   navigation-related services or data are available wirelessly and areas in which navigation-

16   related services or data are not available wirelessly. In the embodiment shown in

17   Figure 9, the areas in which navigation-related services or data are not available

18   wirelessly are shown as hatched. (Instead, of showing these areas as hatched, the areas in

19   which navigation-related services or data are not available wirelessly may be shown in a

20   different color, by shading, by boundaries, etc.) In addition, according to this

21   embodiment, the current location of the end user is indicated on the coverage map. The

22   current location of the end user can be determined using the positioning application

23   (420(1) in Figure 8) or by any other means.

24   According to one alternative feature, a message is overlaid on the display screen.

25   The message indicates to the end user the areas in which navigation-related services or

26   data are available wirelessly. Alternatively, a message may be shown in the display

27   screen that indicates to the end user the areas in which navigation-related services or data

28   are not available wirelessly. Both these features are shown in Figure 9 by means of the

29   boxes containing the words "DATA" and "NO DATA."

30

1   *(2)   Warning about leaving or entering a wireless coverage area*

2   According to another alternative embodiment, the wireless coverage data can be

3   used on the end user's computing platform to provide the end user with a warning that the

4   end user is about to leave an area in which navigation-related services or data are

5   available wirelessly. This warning can be generated by a wireless coverage warning

6   application 420(6)(2) in the end user's computing platform. The warning may be

7   provided visually on the display screen of the user interface of the end user's computing

8   platform. Alternatively, the warning can be provided audibly using a speaker of the user

9   interface of the end user's computing platform. Both visual and audio warnings may be

10   provided. The warning may be provided in combination with the display of a coverage

11   map, as explained above. Figures 10 and 11 show examples of these warning features.

12   According to an another alternative embodiment, a message can be provided

13   when the end user enters a wireless coverage area. The message may be similar to the

14   warnings provided when leaving a wireless coverage area.

15

16   *(3)   Obtaining data for uncovered areas*

17   An advantage of this embodiment is that the end user can make additional

18   requests for data about areas outside a wireless coverage area while still within the

19   wireless coverage area. For example, the user may request navigation-related services or

20   data for areas outside the wireless coverage area. These data for areas outside the

21   wireless coverage area are then saved on the end user's computing platform so that they

22   can be used when the end user travels outside the wireless coverage area. These data can

23   be used to generate map displays, provide routing guidance, and so on. The end user can

24   also request data for a route that extends through an uncovered area.

25   According to another alternative, a wireless data downloading application

26   (420(6)(3) in Figure 8) on the end user's computing platform automatically requests and

27   obtains data for uncovered areas whenever the end user approaches an uncovered area.

28   The wireless data downloading application 420(6)(3) on the end user's computing

29   platform may download all the data for an uncovered area being approached.

30   Alternatively, if the user is traveling along a route to a destination that is located in, or

31   passes through, an uncovered area, the wireless data downloading application 420(6)(3)

1   on the end user's computing platform automatically downloads sufficient data for the

2   uncovered areas through which the end user is expected to travel.

3

4   III.   OTHER ALTERNATIVES

5   In the embodiments described above, it was stated that the end user's computing

6   platform obtained the wireless coverage data from the navigation services provider. In an

7   alternative embodiment, the wireless coverage data may be stored on media located with

8   the end user. For example, in one alternative, the wireless coverage data may be stored

9   on a CD-ROM or DVD installed with the end user's computing platform.

10   In the embodiments described above, it was stated that end user's computing

11   platforms communicated with the navigation services provider to obtain navigation-

12   related services or data. According to alternative embodiments, an end user's computing

13   platform may provide navigation-related services using a geographic database installed

14   locally with the end user's computing platform. According to this alternative a

15   geographic database installed locally with the end user's computing platform is used for

16   certain types of navigation-related functions, such as route guidance, map display, or

17   route guidance. The end user's computing platform communicates with the navigation

18   services provider for certain functions, such as real-time traffic, updates, and weather.

19   With this type of system, the end user can be provided with warnings about leaving or

20   entering wireless coverage areas. When the end user leaves a wireless coverage area, the

21   features provided by the navigation services provider, such as real-time traffic and

22   updates, are not available. However, the features that can be provided using only the

23   locally installed geographic database are still available.

24   According to another alternative, when the end user leaves a wireless coverage

25   area, features that rely on the availability of data wirelessly, such as real-time traffic and

26   updates, are still provided using data that have been downloaded prior to leaving the

27   wireless coverage area. In this alternative, the data that have been downloaded while in a

28   wireless coverage area can be used for a period of time until they become obsolete. For

29   example, in the case of traffic data, an end user who has left a wireless coverage area may

30   be able to use traffic data that have been downloaded from a navigation services provider

1   prior to leaving the wireless coverage area until the traffic data becomes obsolete, e.g., an

2   hour.

3   According to another alternative, when an end user is following a route that leaves

4   a wireless coverage area, traffic related data and updates for the roads in and along the

5   route are downloaded to the end user's computing platform prior to leaving the wireless

6   coverage area.

7   In some of the embodiments described above, it was stated that wireless coverage

8   data are associated with a geographic database to indicate areas in which navigation-

9   related services or data are available wirelessly. In an alternative, the wireless coverage

10   data can indicate areas in which navigation-related services or data are not available

11   wirelessly.

12   In the embodiments described above, end user computing platforms were

13   described as having certain navigation applications, such as positioning, route guidance,

14   and map display. In alternative embodiments, some or all of these navigation

15   applications may reside on the navigation services server. According to these alternative

16   embodiments, end users may be able to operate these server-based navigation

17   applications using their local computing platforms, or may be able to obtain the results

18   from these server-based applications using their local computing platforms.

19   According to a further alternative embodiment, the wireless coverage data can be

20   used to restrict selection of destinations. According to one alternative, when an end user

21   is searching for a destination of a given type (e.g., points of interest, such as hotels,

22   restaurants, etc.), the list of available destinations may be restricted to only those that are

23   located within wireless coverage areas. According to this alternative, destinations of a

24   given type that are located outside wireless coverage areas are not shown to end users as

25   being available. According to an alternative, destinations that are located outside

26   wireless coverage areas may be made available to some users (such as those having

27   systems capable of downloading sufficient data for travel in the uncovered areas), but not

28   to other users. Alternatively, destinations that are located outside wireless coverage areas

29   may be made available to users, but with a warning that the destinations are located

30   outside wireless coverage areas. According to yet another alternative, an end user may be

31   able to choose whether destinations that are located outside wireless coverage areas are

1 returned when searching. According to another alternative, an end user may be able to

2 select a preference for destinations that are located in wireless coverage areas when

3 searching.

4   According to another further alternative, the wireless coverage data can be used to

5 restrict calculation of routes. When calculating a route to a destination, a route

6 calculation application (located on either the navigation services server or on the end

7 user's computing platform) may restrict the road segments available for inclusion in the

8 route to those located in wireless coverage areas. According to an alternative, an end

9 user may be able to choose whether any portion of a route crosses outside wireless

10 coverage areas. According to another alternative, an end user may be able to select a

11 preference for routes that are located in wireless coverage areas so that routes remain

12 inside wireless coverage areas whenever possible.

13

14   It is intended that the foregoing detailed description be regarded as illustrative

15 rather than limiting and that it is understood that the following claims including all

16 equivalents are intended to define the scope of the invention.

17